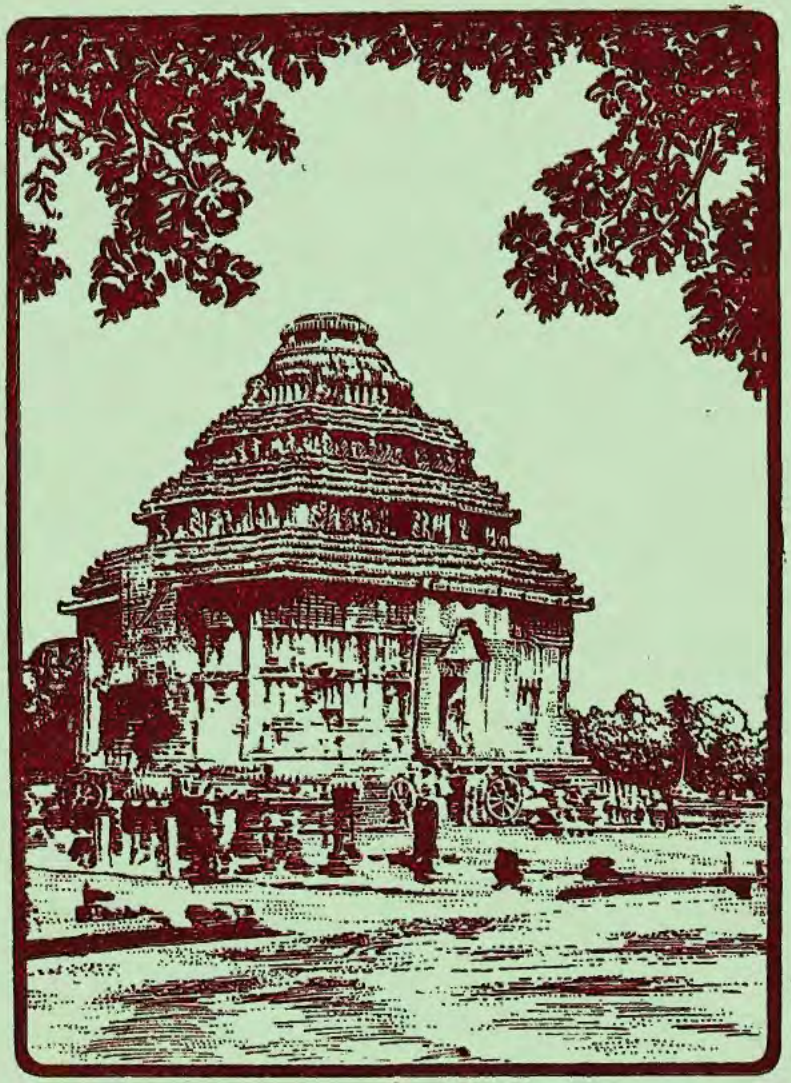
THE SUN TEMPLE AT KONARAK—

A Technical Overview from its Construction to Ruin



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Introduction

The Sun Temple at Konarak, a stupendous structure and magnificent fabric was built in the 13th Century A.D. during the Ganga period by Raja Narasimhadev-I. From many considerations, it was an ambitious project ever attempted in India and in the present paper, the technical aspects of building this grand edifice and circumstances leading to its ruin have been discussed.

PERIOD OF CONSTRUCTION :

Recently a palm-leaf chronicle of building operation of the temple, *Baya Cakada* has been discovered, wherein it has been incidentally mentioned that although the construction started towards the end of the fifth *anka* of Narasimha-I's reign (1238-1264 A.D.), planning, quarrying of stones and recruitment of people had begun some six years earlier. The above fact is corroborated by an entry in *Madala Panji* that Narasimhadev-I conceived and began to plan the temple, when he was a crown-prince. According to *Baya Cakada* the construction ended with consecration of all shrines during the eighteenth *anka* of Narasimha-I, the period of construction spreading over 12 years 10 months and 14 days. The presiding deity Mahabhaskar was installed on Sunday, *Magha Sukla Saptami* in A.D. 1258. The same date is recorded in *Madala Panji* (fascicle No. 6 of Narasimha-I). The Period of about 12 years is incredibly short for the construction of such a mammoth structure, which was built with utmost precision and astnonisingly clear foresight. Narasimha-I wished that the temple should be consecrated on Sunday, *Magha Sukla Saptami*, which could only happen once in seven years. Therefore no time was lost between one stage of the work and the next. In the early years of construction, work was temporarily stopped during the rainy season and workmen were sent home whereas in later years, the work continued throughout the period of monsoon.

SOURCES OF FUNDS :

Narasimha-I, according to *Madala Panji*, had to fight in the South for 3 years, when he was only eighteen, as a Commander-in-chief of his father's army. After victory, he returned with many treasures and his mother suggested to use this booty for building a very big shrine for the Sun-God at Konarak known as Arka Kshetra. As the enthusiasm of the builders seemed to have caught the appreciation of entire population, copious gifts of money, cloth and jewellery, grains and other food stuffs, milch cows and coconuts, timber, bamboo, ropes, iron ore, copper & borax etc poured in from all sides. Stones, stone cutters and sculptors were also sent by neighbouring Rajas, landlords, religious orders and associations. The

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celebrated historian of the court of Akbar, Abu'l Faz'l mentioned in A'in-i-Akbari (A.D. 1581) that the cost of construction was defrayed by twelve years revenue of the province. Historian Krupasindhu Mishra had assessed the cost as Rs. 40 crores (Odisha Itihas by Dr. H. Mahtab, Page-150), presumably as per the then rupee value.

LAYOUT OF SHRINES :

The temple complex is enclosed within a compound measuring 857ft. x 540ft, about 11 acres with gateways on the east and south. On the east-west axis, one observes the remains of the *deul* (main temple) i.e. mostly the platform portion, *Mukhasala* or *Jagamohan* and separated by a distance of 30 feet, a *Natamandir*. The remains of a platform for musicians *Bajenimandap* could be seen between *Jagamohan* and *Natamandir*. To the south-west of the *deul* is the remains of *Maha Gayatri* temple, while behind this structure, in the south-west corner is a ruined brick temple of *Narayan*. Foundation of several other structures exists within the compound including a *Parayatra mandap* for ceremonial occasions, *Nyas mandap* for consecration of the puja image. There are also several smaller platforms, two wells and some distance to the south of the *Natamandir*, the remains of a large kitchen. To the south east of the compound is a tree *Arkavata* mentioned in the *Surya Tattva Vistar*.

MATERIALS USED IN THE CONSTRUCTION :

Three basic kinds of stones were used in the structure, none of which were available in the vicinity like Laterite. locally known as *mankada*, iron-rich but porous which was used, in the invisible core of the platform (Pitha), foundation, stair ways to the *Mukhasala* and parts of the enclosing wall. Ultrabasic rock i.e. chlorite locally called *muguni* was restrictedly used in the door frame, architrave, sculptures within the niches of projecting *pagas* & pedestral of the puja images as well as the image itself and *Arun* pillar. The ultrabasic rocks combine hardness with easy workability and admits of very fine workmanship. It mostly contains Pyroxene (Silicates of calcium, iron, magnesium and aluminium) and occasionally garnet which make them look like mosaic. The third type is Khondalite locally known as *bagadkanda, ranga-dalima, boul-mala* etc. which form the major part of the construction. Khondalite stones are of gneissose structure, flaky and constituent mineral layers are laid in parallel planes with the presence of soft graphite and easily weathered felspar which make the stones workable. The rock shows a variety of colours like grey, whitish and reddish and some time three colours appear as bands in one stone slab. Khondalite when rich in felspar is whitish and reddish when rich in iron. Use of khondalite, an easily weathred rock, has largely contributed to the ruin of the temple as felspar easily falls to soft powdery kaolin. To quote Debala Mitra "The selection of this easily-weathered garnetiferous felspathic gneiss proved fatal to the monument. In many places the constituent felspar has been altered to Kaolin and serpentinous material and the garnet has been decomposed to a spongy mass of oxide."

Besides stones, heavy iron beams were used in the construction. Iron beams were used as supports under the roof, and under the lintel or architraves above the door ways. The *navagraha* slab over the eastern doorway of *Mukhasala* was placed above the iron beam. Iron clamps were used to hold the stones together particularly in the uppermost part of the main temple. There were as many as 29 iron beams of different lengths to suit the purpose of spanning. The longest beam was 35 ft. 9 inches in length with cross section of 7 inches

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square (Odisha Itihas—Dr. H Mahtab). There was another beam of 23.5 feet in length having a cross sectional area of 10 inches x 10½ inches. These beams were of wronght iron.

The manufacture of these beams speaks of our metallurgical achievement in the thirteenth century and good knowledge in the smelting and forging operation. With regard to the process of manufacture, opinions widely differ. Some say that the iron flats were placed one upon the other and on sides and then molten iron was poured to make it a beam. But this view is not accepted as the fuel being charcoal, required temperature to melt the iron could not be attained in the furnace. On the other hand reduced ores were obtained in form of spongy puddled mass or blooms which were subsequently made flats and forge-welded in successive layers to make a beam. The iron beam produced in this way was neither homogeneous nor uniform in cross section and invaribly voids were visible when broken. The flats were 7/8 inch × 3/8 inch in cross section and the tensile stress of the wronght iron beams was in the order of twenty tons per square inch (Orissa Itihas—Dr. H. Mahtab). Most of the beams were corrosion resistant although lying very close to the sea and it might possibly be due to low sulphur and manganese content compared to phosporus as in 100 parts, the iron was 99.720, phosporus 0.114, sulphur 0.006 and mangnese-nil and to quote: "the puddling process used in ancient days led to the formation of a layer of slag over the surface which was inert to all electro-chemical action involved in corrosion". (Lahiri, Banerjee and Nighawan).

STONE QUARRIES AND TRANSPORTATION

It can not be definitly said from which place or quarries stones were brought and used in the construction as the bulk of the stones used was Khondalite and no Khondalite quarries were traceable in the vicinity of Konarak temple. According to Dr. H Mahtab (Orissa Itihas, page -151) Konarak, was a port at that time and stones were transported on sea. In the Annual Report of the Archaeological Survey of India for the year 1902 03, it was indicated that the huge blocks of stones used in building were brought from the hills near Khurda, some thirty miles away and from even more distant places. Krupasindhu Mishra suggests that the builders of Konarak must have gone atleast up to Khurda for stones. Peary Mohan Acharya located the quarries of Khondalite stone to the west of the hillock called Viswanath munda near Motari station on Khurda Road-Puri railway line on the left bank of river Daya. Some authors suggest that Khondalite was brought from Naraj hills. The above suggestion is corroborated by the presence of slope from the hill to the river through which the stones were rolled down. On the north and north-west head of Mahanadi Delta there were quarries of Khondalite intruded by the dykes of chlorite and covered under alluvium or appearing as rock-outcrops.

The transportation of boulders was on sea, along the rivers by rafts and thirdly on the land routes. Rivers of Orissa are rain fed and transporation was only possible in rainy season when the rivers were in spate. Water route was primarily along the river Mahanadi, Kathjuri, Kushabhadra and its small branch (partially an artificial cut) by the side of Konarak temple known as *Pathar buha* (stone carrying river); the remains of an old course is traceable for a short distance.

It is suggested that "heavy and large blocks of stones were also transported by wheeled carts dragged by men from village to village till the site was reached. It was obligatory on one village to drag the cart to the next village and thus the whole was trans-

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ported by a sort of relay with co-operation of people from several villages". (Dr. K. S. BEHERA).

Leaf V of *Baya Cakada*, reveals that stones were brought from Khiching. The entry (English Version) is quoted below : "Raja of Mayurbhanj Cakradhar Bhanja, the Moon of the Bhanja kula sent 10 Khiching silpis and 100 Khiching stones over the Mahanadi. The men who brought the stones received : 3 madh and each one a pair of cloth."

DIMENSIONS :

Deul (main temple) and *Jagamohan* rest on an elevated platform (Pitha) which is 13 ft. high. The entire structure has been conceived and designed as a wheeled car simulating the chariot of Sun God pulled by seven horses, four appearing on the south and three on the north in the eastern stair case in front of *Jagamohan.* There are 24 wheels arranged at regular intervals, 12 wheels appearing on both north and south sides of the temple consecrated to the 12 constallation or signs of Zodiac corresponding to 12 months of Sun-God's yearly course. The wheels, 9 feet 9 inches in diameter are richly ornamented at every surface and provided with eight major spokes & eight tie rods.

Abu'I Faz'I had given an account of the temple in A'in-i 'Akbari (A.D. 1851) in respect of height and thickness of walls "The height of the wall is 150 cubits (225 ft.) and 19 cubits (28 feet and 6 inches) thick." The height of *Jagamohan* is 128 feet from ground level minus the surmounting *Kalasa*. The *Jagamohan* measures 60 feet square on the interior and 94 ft. on the exterior. The walls are 17 ft. thick at the base. If Abu'l Faz'l's account about the height of the temple is accepted, then it was the highest in India as the *sikhar* of Rajarajeswar temple at Tanjore which stands intact to this day is only 210 feet.

DISTINCTIVE FEATURES :

Konarak temple has varieties of distinctive features in construction, architecture, multitude of sculptural decoration and erotic images etc. We will discuss about the constructional aspect with use of massive and prodigous blocks of stones and their haulage to soaring heights. One of such huge stone was *Navagraha slab*.

Navagraha slab :

A single piece of chlorite slab weighing about 26.67 tons was a decorative piece in the eastern architrave of *Jagamohan* placed over iron beam supported by framing pillars. *Navagraha slab* is 20 ft. in length, height and thickness being 45 inches and 48 inches respectively. The supporting iron beam was 21 feet in length. Raja of Khurda dislodged the slab from its original position and lowered it with great difficulty which resulted the death of a workman. He was directed by Govt. in 1838 not to remove any more stones from the site. In 1867, the Asiatic Society of Bengal attempted to remove it to the Indian Museum at Calcutta, but managed to move it abcut 200 yards. The report of G. Raynor, Executive Engineer, Puri Division, who examined *Navagraha slab* in 1860 observed — "Twelve 4 inches planks, eight salwood logs for rollers, fifty hand spikes, twenty-five crow bars and six 2 inches ropes of a hundred feet long and fifty men might in four days move the stone to the sea side. But how to raise it on the ship with usual tackle, I am unable to state, for I fancy that no gearing on a pilot vessel is strong enough to move the stone and if it did bear the weight, the vessel might be thrown on its side and all might go to the bottom of the sea".

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In A. D. 1892, a second attempt was made to remove the slab to Calcutta and to make it lighter for carriage, the stone was sliced longitudinally in to two halves, reducing the original thickness of 4 feet to 1½ feet with carved slice placed on a specially made truck though it was carried only a few yards further. Due to the objection of the local people on religious ground further attempts for removal were abandoned in A.D. 1893. In A.D. 1953, it was removed to a new sculpture shed beyond north east corner of the enclosure.

Gajasimha :

The lion on elephant sculpture projected forward on the east from the spire of the main temple at a height of about 150 ft. The huge sculpture was maintained in balance by the super-imposed load of upper portion of the temple. After fall, it is lying on the ground on the north of the temple in three fragments. The height of the sculpture, when taken together measures 20 ft. to the top of the lion's head. The elephant is 15 feet long and 4ft. 7" inches wide at the base. Similar type of *Gaja-Simha* sculpture placed in front of *Natamandira* according to the calculation of M. M. Ganguly, an engineer weighs 750 mds. or 27.48 tons.

The placing of the ponderous block of *Gaja-Simha* stone at a height of 150 feet was a herculean task. The following accounts of the *Baya Cakada* throws some light about the haulage and placement of this enormous block of stone.

"72 youngmen picked for their strength (bhenda) brought the lion stone by cheka-sangi (extended sangi) to the scaffolding on the plinth... When the lion reached the scaffolding, it was placed with head down on the *prava* and was tied on it with three ropes......Six ropes were gathered two by two and passed over three pairs of wheel. Seventy people pulled the ropes from the top of the *Mukhasala*......On either side thirty people with four wooden poles altogether 60 people propped the stone when lifted step to step, from the scaffolding of every tier......When back of the lion came in front of the second *pidha*, 40 people with 10 ropes, 2 tied to the head of the lion went on the scaffolding of the *garbhagandi* and from there pulled the lion which had reached the projecting girders. At the time of hauling the lion, the drummers were playing with *badakatha* with all their strength......When the lion stone was seated on the iron girders, 30 people went on the top of the *garbha* and pulled the ropes fitted on the lion with all their strength. At the same time 30 people with big *asas* pushed the stone upward, standing on the second *pidha* of the *Mukhasala*......On the evening of 13th day of Magha when as two watches (prahars) were left, the lion stone rested on the top of the ceiling of the *Mukhasala* and was propped up with 20 wooden poles...... There was a sloping scaffolding from the *mukhasala* roof to the elephant pedestral in the cavity for the lion. The lion was tied with strong ropes on a sagadi with 12 wheels......When the lion (on the Sagadi) was set on the scafolding 32 people pulled it with ropes from above and 32 people supported with *asas* from below......While dragging up, the lion by its weight shook the scaffolding and 12 people Narayan Mohapatra, Agadhu Pathuria, Rama, Daya, Sunguria, Pathani and others fell from the scaffolding. Thirty guards lifted and carried the injured to Gurudia Vaidya......The hind portion (Tenon) of the lion stone was tied with six ropes on which big stones were hung and were let down to the interior of the temple". × ×"

Dome of Jagamohan :

"The massive dome forming the crowning elements of *Jagamohan*, was 25 ft in thickness and is estimated to weigh not less than 2000 Tons. This had to be lifted to a height of

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128 ft above the ground" (Dr. K. S. Behera). This indicates the strong determination, physical strength and technical capacity of the builders as no power driven machinery for lifting and dragging of stones was even contemplated in the 13th Century.

CONSTRUCTION TECHNIQUE :

The main temple is a tall tower of about 225ft. high having the following cross-sectional area at the base : 65ft 8 inches square on the exterior and 32ft square in the interior. It, together with *Jagamohan* rests on a spread out platform of 13ft in height having a wide verandah-like allaround. The smaller area of the main temple at the base in proportion to the soaring height could have looked fragile and thus depriving the fabric of sublime dignity. Therefore while formulating the plan at the initial stage, provision was made for the subsidiary shrines in front of the *Parsvadevatas.* These structures form an integral parts of the whole scheme. Further, technically by clustering these shrines in 3 sides except the *Jagamohan* side added more base-width and mass at the bottom part of the tower, to make it more stable and strong. Therefore the imaginary vertical line passing though the centre of gravity of the whole structure had been prevented from falling outside the base of the temple. In case of *Jagamohan*, however, it is structurally safe, because of pyramidal form of the roof and comparatively broad base in relation to its height.

Foundation :

Baya Cakada, throws some light about the foundation of the temple. According to norms of *Silpasarini*, the depth of foundation should vary from one third to one fourth of the height of the temple. The foundation should be completed in 4 layers up to the ground level. The lowest layer consists of coarse grained sand, the second is rough stone and these two layers should be bound up with earth. The third layer is made of laterite blocks (*mankada*) in form of stairs in the lower part and fourth layer is built with solid stones and consolidated with mortar. Details of the foundation of Konarak temple can not be precisely stated, but from the record of *Baya Cakada*, a speculative view. however, can be taken.

"To 18 teams who under their chief removed the sand for excavating the foundation 54 hasta (81 ft.) deep and for removing the sand on both sides ; received 208 madha." "To the labourers for setting rough stone into the foundation : received 304 madha." "For filling (the foundation) with gravel to Raghu Ojha; paid 140 madha". (Leaf IV of Baya Cakada) — one madha = ½ tola.

Many authors are of opinion that on account of settlement of foundation, the main temple had collapsed. James Fergusson, for example was inclined to think "That the failure of marshy foundation that supported so enormous a mass was by far the most probable cause." Rajendra Lal Mitra was of view that like collapse of pillars in *Jagamohan* on account of sinknig of their bases, the main temple had the same fate. Historian Hunter and Percy Brown suggested that the temple could not be finished as the foundation gave way. But the above observation was contradicted by the report of M M. Ganguly, an Engineer, who stated after careful examination of the temple: "I examined the temple very carefully and did not notice anywhere the least trace of the subsidence of the soil. This would have, as a matter of course, occasioned vertical cracks in the structure and horizontal cracks in the floor of the sanctum. The floor, I have noticed is without any crack, moreover, the collapse due to the subsidence of the soil would have tumbled down the temple on one side which did not occur actually".

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Further, the Engineers of the Archaeological Survey of India who have supervised the large scale repair of the temple since 1992, have not detected any instability of the temple.

In this connection, it is to be stated that Konarak temple was completed, all shrines were properly consecrated and rituals continued for about three centuries till the main temple collapsed. It is not within the scope of this article to prove the veracity of the above statement.

Method and Mode of Construction :

It can not be said with certainty with what device the work proceeded and heavy stones were lifted from lower height to higher. It was perhaps a traditional notion that an inclined plane or slope with earth or sand was built up alongside the construction and heavy stones were dragged along the slope. But it is difficult to accept this view in as much as the slope has to be changed frequently as the construction proceeds higher up. It is also suggested that the temple was gradually buried with earth or sand to facilitate lifting of stone and builders to work and with constructional activity proceeding higher, the temple was buried further. This view also can not be accepted as co ordination can not be established with sculptures at lower level already buried. As the carvings were made in-situ after the stones had been placed in position, lack of unity and co-ordination was inevitable, if the lower portion is buried. Therefore it is not unlikely that scaffolding was made with seasoned and strong timbers and the heavy materials were hauled up with use of some kind of pulley, wooden rollers and planks locally called *Sagadi, Kapi, Cara,* and *Carapata* etc. This corroborated with entry in *Baya Cakada*. One entry out of many is cited below for procurement of timber for the purpose.

From forest of Golara : 1100 tinia logs, 230 bandhan planks 200 panas, 300 mango beams. (Leaf VII of Baya Cakada.)

It has been stated earlier that principal stone used in construction of temple, was Khondalite, an easily weathered rock having gneissose structure. Therefore while placing stone slabs one upon the other the plane of gneissosity as far as possible was always horizontal and load acting on it was more or less vertical. Load acting in direction other then vertical would impair the stress bearing capacity. Therefore with Khondalite a true arch design was not adopted in the temp'e.

The constructional method was simple, one stone was placed upon the other on the plane of gneissosity and the stones were gradually projected inward to reduce the internal space. The stones were held in position being balanced by the load of upper layers. The method was commonly known as corbelling. To impart stability to the walls built on the principle of corbelling, the stability was established by tying the opposite walls by means of number of *mudas* or ceiling at regular intervals commensurate with the height of the temple. *Garbhamuda* or the bottom ceiling rested over iron beams and no pillars were built to provide support.

The mode of construction is slightly different in *Jagamohan* having pyramidal form of roof. The interier of *Jagamohan* is inaccessible being sealed to preserve the structure from collapse. The upper ceiling was corbelled and by means of oversailing course of masonry, each course projected beyond the one below, thus enabling the sides to converge gradually towards the top. About halfway up, a false ceiling was added consisting of huge laterite

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lintels supported by four massive pillars. Each lintel was reinforced by a number of wrought iron beams, while many other iron beams placed in a manner to form an iron-grid or frame work of immense strength. The massive pillars which divided the floor were still standing, when Fergusson visited the site in A D. 1837. When Rajendralal Mitra, however, visited the site in A.D. 1868 the pillars were lying fragmented on the pile of rubbish and number of iron beams. As earlier stated in the article. R. L. Mitra suggested the collapse of the pillars for subsidence of pillars below their base. This view can not be accepted, as *Mukhasala* walls remained intact, without being affected by subsidence. The pillars most likely fell during the gale of A D. 1848 which decimated the remaining portions of the main temple.

The masonry used in the construction was without any mortar except for the top portion. Stones were safe & stable in their respective position by means of balance. The stones were properly cut and their faces were so finely dressed that when placed one upon another, the joints were hardly noticeable. At places, iron dowels had been used to keep the stone slabs in position.

RUIN :

This ambitious monument was built by an ambitious king with soaring height and using prodigous blocks of stones. The causes of the downfall and ruin of the temple can not be precisely established except to work under hypothesis to attribute some reasons. We have earlier discussed that subsidence of the foundation was not the cause; natural calamities like earthquake and lightening may be ruled out as the main temple only collapsed and not the *Jagamohan*, adjacently located, Probable causes may be stated as under :

i) Undue haste in finishing the work : By the time the temple was built, traditional technique of building monuments had become almost perfect and collapse could not be attributed for lack of technical knowledge, clear foresight and mathematical precision. We have stated earlier that Narasimha-I wished to consecrate the shrines on *Magha Sukla Saptami*, the great festival of the Sun-God, falling on a Sunday. This could happen only once in seven years. The date seemed to have been fairly near, Raja repeatedly urged the *Sutradhar*, to speed up the work. After the huge *Gajasimha* was installed on the eastern facet, the ceiling of the *sikhar* then had to be closed. *Sutradhar*, who always planned his work most carefully and systematically wanted to complete the task on later date; but the Raja however, insisted on closing the ceiling (*Muda*) about a fortnight earlier and the wish of the Raja fulfilled. But later, when *beki* was set up on the roof of the *sikhar*, symptoms of instability became evident. The stones of the *beki* would not stand firm, were twice re-set and finally had to be consolidated with iron clamps, which were not earlier foreseen. Later, when *amalak* with the *khapuri* had been fixed and the time came for setting the *Kalas* of the main temple, still worse difficulties arose and the *kalas* could not be set up. To avoid catastrope a new *kalas* was fixed in to the *Khapuri* with an egarupattika, a kind of pyramidal pedestral embracing the foot of the *Kalas*. According *Baya Cakada*, copper bands (*capuani*) were employed to fasten tegether the two halves of the *egarupattika*. These belts were called *Cumbak loha*, which also means magnet or lode-stone on the top of the temple which supposedly attracted ships to the shore. The new *Kalas* however was made of stone formed in two parts and hollow, the interior filled with jewells and precious stones. The Lotus finial (*dhwaja padma*) resting over the *Kalas* was made of

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metal studded with rubies. It was this, along with the contents of *Kalas* which attracted plunderers, not the *Kalas* itself. The above modified mode of construction was suggestive of the fact that something had gone wrong with understructure, perhaps it had not been made solid enough or had not been allowed sufficient time to settle properly to find its own balance. Further the uppermost part of the *Sikhar*, the most exposed part of the big temple was eventually plastered over with lime. "What could have induced the *Sutradhar* to disfigure his exquisite temple in this way, except the fear that its upper most part might not be strong enough for long to withstand wind and weather and desired to consolidate it in whatever was possible at that stage of the work ?" (Boner, Sarma & Das).

ii) Attack of Kalapahar : Indigenous written sources indicated that during the reign of Mukundadev in A.D. 1565 the Muslim rulers of Bengal under the Hindu renegrade and iconoclast Kalapahar attacked Konarak temple and being unable to break the temple took away *Kalas* and Lotus finial. There is no positive evidence that Kalapahar attacked Konarak temple. In A D. 1581, the celebrated historian Abu'l Faz'l visited Konarak temple and his accounts in "Ain-i-Akbari" run as follows :

"Near Jagannath is a temple dedicated to the Sun. Even those whose judgement is critical and who are difficult to please stand astonished at its sight." This sufficiently indicates that the temple was intact by the time Abu'l Faz'l visited the site. That the temple was in worship even in early 17th century is confirmed by another entry in *Madala Panji* (Fascicle No. 3 of Purusottamdev of Khurda dynasty). Had the temple been desecrated by Kalapahar the worship could have ceased.

iii) Desecration by Mughal Subedar : With the death of Mukundadev, the Orissa lost its independence and its territory passed on to the hands of Afgan Rulers of Bengal. By A.D. 1592, the Orissa was fully under the control of Mughals. One Bakhar Khan was the Subedar of Orissa. He was very oppressive and his autrocities knew no bounds. In the early part of A D. 1628, he led an expedition to Konarak following the example of Keshodas Maru, a Rajput jagirdar who plundered the Jagannath temple. It is again guessed that under the orders of Bakhar Khan, the *Kalas* was dislodged, the jewels inside of it along with the ruby-studded lotus finial was plundered. This must have created impact on the masonry and opened up the joints.

Shortly after in the some year i.e. 1628, the huge *Gaja-Simha* sculpture fell down from a height of about 150 ft. with the result that eastern and northern walls collapsed. However, the southern and western wall remained upright to a height of 140-150 ft. atleast until 1837, when Fergusson visited the site This strip remained upright until decimated by a strong gale in October 1848. The fall of the huge *Gaja–Simha* may be taken as a cause for the large scale collapse. The fall was due to defective construction of the upper part of the *Sikhar* as narrated above accelarated by the breaking impact of *Kalas* and *Lotus finial* by Bakhar Khan's army in the same year.

A few years before the fall of the *Gaja-Simha*, the *Pujharis* neglected the daily worship and no efforts were taken for repairs and maintenance of the temple. The rain water, percolating through the dry joints acted on Khondalite stones and the felspar content of the rock decomposed to powdery Kaolin. The collosal *Gaja-Simha* sculpture, exerting a terrible pressure on the tenon was not counterbalanced due to lack of solidity in the upper portion

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and the result was the fall after nearly 300 years of slow and gradual deterioration of supporting masonry.

iv) Political condition and status of Khurda Raja : The political situation of the territory was so chaotic that the Raja of Khurda was completely powerless to repair and preserve the temple for the invasion of Mughals on the north and Sultans of Golkunda on the south. Gajapati of Khurda could not even protect the Jagannath temple and again and again Sri Jagannath was shifted and reinstated due to frequent attacks of the Muslim rulers. The religious life of Orissa underwent a change with advent of Vaishnivism and worship of Jagannath only had the royal patronage. The Sun-worship declined and subsequently stopped. Along with it, Konarak temple lost its importance as a Kshetra and this was further hastened by shifting the Puja image to the premises of Jagannath temple at Puri. The place was deserted and natural process of deterioration followed and accelerated by saline climate.

v) Natural factors : The site was gradually deserted on account of natural factors. There was a steady and continuous north-ward littoral sand drift along the coast. The drift helped the formation of sand dunes across the mouth of the rivers, thereby changing their natural courses. In case of Kushabhadra, the *Patharbuha* branch flowing near the temple practically disappeared and water way communication to the site ceased to exist. The land route to the site was only fair-weather as a number of cross drainage works were unbridged. All-weather communication by road was established in A.D. 1958-60. The inroads of drifting sand also affected the place. In course of time the drifting sand caused unbroken chains of sand dunes and made the place unsuitable for human habitation. By the end of 19th century, the wheels of the temple, Natamandir and other subsidiary structures were covered by heaps of sand and only from A. D. 1901, the sand was cleared and gradually the structures came to public view.

vi) Portuguese attack on the temple : Till today a strange fable gains ground that the *Cumbak loha* (magnet) lodged on the summit of the main temple had the effect of dragging ashore all ships passing near the coast. The sailors, as a remedy scaled the tower and carried off the lode stone. These sailors were stated to be Portuguese pirates and for their piratical activities along the eastern coast, they took shelter in the deserted temple. The story of the magical magnetic slab appears improbable as it would have been a sheer impossibility to use iron tools and implements near the temple, had such a thing been a reality

Dr. H. Mahtab in "Odisha Itihas", page-152 has firmly viewed that the Konark Temple was desecrated by Portuguese pirates by use of explosives as their ships were drawn ashore by the action of two powerful magnets placed at the top and bottom of the presiding deity, thus making the idol dangle in space simulating the movement of Sun-God in the sky. This appears to be improbable as except the electro magnet, no normal magnet, can create a powerful magnetic field to hold the huge chlorite idol firm in space.

vii) Despoilation by Human agency : For over 200 years, the site and the dilapidated temple became nobody's concern and multitude of sculptural decoration was taken away mostly due to plundering that went unimpeded. The iron clamps, which held the

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stones together were, with force, removed by the inhabitants of the neighbourhood, thus making the stones loose and unstable. *Arun* pillar was removed by Marathas in the 18th century and was planted in front of Jagannath temple, Puri. Some of the finest sculptures from door ways had been removed by the Raja of Khurda, one of the leading despoilers of the temple. We have discussed earlier, his attempt to take away *Navagraha Slab* after dis-lodging it. He demolished all three entrances of *Jagamohan* in his quest for chlorite images. There are ten *graha* images in the British Museum, London averaging 38-39 inches in height including two images of Surya. Like-wise a *graha* image of 38½ inches in height is in Indian Museum, Calcutta. There are 4 cult images of Nataraj, Ganesh, Mahisa-mardini and Surya measuring 40 inches to 42 inches in height in British Museum, London. An image of Vishnu now in the National Museum, New Delhi was found near the temple in 1906-07 during the clearance of debris from the sanctuary.

The above are the few example besides the dispoilation by the inhabitants of the neigh-bourhood who took away the cult images for worship. Some of the finest sculptures went to private museums and influential aristrocrats.

viii) Lack of Maintenance : Lack of maintenance, repairs and preservation for about three centuries have largely contributed to the ruin of the temple. Lingaraj temple at Bhubaneswar and Jagannath temple at Puri, though built earlier have remained intact till today for timely repair and preservation. As Konarak temple lost the patronage of the rulers and the place was deserted on religious grounds (the presiding deity was removed to the precinicts of Jagannath Temple) and for geographical reasons, the temple was thrown in to oblivion (except for one day i.e. *Magha Sukla Saptami* in a year) for centuries together less to speak of repairs and maintenance. In a tropical country like India, an abandoned monument is always covered with vegetation, moss and lichens. The roots of the vegetation worked their way to the dry masonry and tore it to pieces. Khondalite, an easily weathered rock was susceptible to decomposition to form powdery Kaolin by seepage of rain water. In 1858, J. B. Mactier, Collector of Puri approached his Commissioner to permit him to spend Rs. 50/-from the Town improvement Fund for removal of obnoxious vegetation from the temple surface and fill the interior of *Jagamohan* with sand and stone. The reply of the commissioner G. F. Cockburn is quoted below : "There is no reason whatever way a single rupee be expended in keeping up the present detestable remaining part of the old temple". Till 1881, not a pie was spent for repair of the temple. From 1901, steps were taken for conservation of the monument The sand and debris were removed, the platform of the temple (13 ft high) wheels (9ft. 9 inches diameter), guardian animals, Natamandir, *Simhasan* of the presiding deity etc gradually came to public notice.

BUILDERS :

This enormous work could not have been a reality without the co-operation and colla-boration of patron, administrators, artisans and labour forces. Foremost among them was Sadasiva Samantaraya Mahapatra, who held the title of 'Sutradhar'—the holder of the thread. In fact he was the creator and actual designer of all buildings under the inspiring guidance of King Narasimhadev-I. He was the final authority on every point of construction down to last detail. He had, at his side, able associates : Gadadhar Mahapatra, Chief Executive Architect who had the title of "Silpi Nayak", Ganga Mahapatra, Head of the Sculptors,

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called "Pathuria Paryanga Kula Nayak"—head of the sculptor community of Paryanga (district), Narayan Mahapatra, Master Sculptor and Viswanath Mahapatra, Specialist in royal scenes and portraits.

They have built this splendid and grand monument as human means and artistry would allow without craving for their name and fame conveyed to posterity.

Conclusion :

Since 1939, the Archaeological Survey of India has been assigned with the job of conservation of the temple and from 1952-53, the dilapidated temple is undergoing special repairs. It is gratifying to note that this grand edifice is attracting the world opinion for its restoration. According to a news paper report, (Asian Age, dt. Nov. 23, 1997) UNESCO has sanctioned $ 39,000 (around Rs. 14.00 lakhs) in its first phase of preliminary Survey of conservation programme.

We would humbly suggest that, *Jagamohan* which is more or less intact though stripped off its sculptural decoration should be relieved of the intense pressure inside created by filling of sand and boulders. Removal of sand and boulders is possible by opening one of the portals sealed, all the while guarding against the total collapse of the structure. The sculptural pieces and images that are lying in Konarak Museum, and those strewn and hidden under sand in the nearby jungle recoverable by means of combing should be assembled and installed in appropriate niches of *Jagamohan* including placing the dislodged *Navagraha* slab over the eastern architrave. A new chlorite *Arun* pillar, should be carved and installed in place where the old one (taken by Marathas in the 18th Century to Puri) was existing. The entire structure should be treated with chemical and carefully grouted, if necessary, to protect Khondalite stones and the entire structure against salinity. The broken parts of wheels and guardian animals of the platform should be replaced, by new carvings and treated with chemicals.

With regard to the rebuilding of the main temple which is as good as building a new one over the high platform, much depends upon the finance, gesture of the government and public participation although a *stapattis* are available till today to undertake the challenging job and restore sublimity and grandeur in the face of this tragic-striken majestic edifice.

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